PB-244 138

THE TRANSPORTATION CONTROL PLANNING PROCESS: FINDINGS AND RECOMMENDATIONS FOR IMPROVED DECISION-MAKING. PHASE I

Elizabeth Bennett, et al

Massachusetts Institute of Technology

Prepared for:

Environmental Protection Agency

27 March 1975

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TECHNICAL REPORT DATA
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1. REPORT NO. CTS Report #75-4	2.
3. PB 244 138	
4. TITLE AND SUBTITLE: The Transportation Control Planning Process: Findings and Recommendations for Improved Decision-Making	5. REPORT DATE: March 27, 1975
	6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S): Elizabeth Bennett, Greig Harvey, Marvin Manheim, John Suhrbier, Mabelle Bessey, and Joseph Bain	8. PERFORMING ORGANIZATION REPORT NO.: CTS Report #75-4
9. PERFORMING ORGANIZATION NAME AND ADDRESS: Center for Transportation Studies, Massachusetts Institute of Technology, Cambridge, Massachusetts	10. PROGRAM ELEMENT NO.
	11. CONTRACT/GRANT NO.: Cont. # 68-01-2476
12. SPONSORING AGENCY NAME AND ADDRESS: Environmental Protection Agency, 401 M. Street, S. W., Washington, D. C.	13. TYPE OF REPORT AND PERIOD COVERED
	14. SPONSORING AGENCY CODE
15. SUPPLEMENTARY NOTES	

16. ABSTRACT

Findings and recommendations on methods of air quality maintenance and transportation planning are presented. The report focuses on transportation control plans and identifies several problem areas, including uncertainties in air pollution data, tight planning deadlines and limited resources, lack of information on transportation control options and their impacts, difficulties in intergovernmental and interagency relations, and breakdowns in communication with the affected public. The research indicates means by which the air quality planning process can be strengthened. A program for improving public understanding of air quality issues is needed. A continuing air planning process needs to be established, recognizing that a great deal of knowledge has not yet been accumulated in the field. An experimental attitude needs to be maintained with a willingness to try new techniques. Social and environmental affects as well as transportation and air quality issues should be evaluated in the planning process. Both existing and new transportation projects of potential benefit to air quality should be monitored carefully; information developed from monitoring should be widely distributed so that it provides guidance for other transportation control planning efforts. More planning on the local levels should be encouraged. Finally, more explicit coordination with the ongoing activities of other agencies is recommended.

17. KEY WORDS AND DOCUMENT ANALYSIS

a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
transportation control plans; air quality planning; Clean air Act; Federal-State-local relations; regional planning; environmental planning; transportation planning		

PRICES SUBJECT TO CHANGE

18. DISTRIBUTION STATEMENT: release unlimited	19. SECURITY CLASS *(This Report)*: none	21. NO. OF PAGES: 53
	20. SECURITY CLASS *(This page)*: none	22. PRICE: 4.25/2.25

EPA Form 2220-1 (9-73)

234167

PB244138

CTS Report No. 75-4

THE TRANSPORTATION CONTROL PLANNING PROCESS: FINDINGS AND RECOMMENDATIONS FOR IMPROVED DECISION - MAKING

PHASE I

Final Report

to the

Environmental Protection Agency

by

Elizabeth Bennett, Greig Harvey, Marvin Manheim, John Suhrbier,
Mabelle Bessey, and Joseph Bain

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Center for Transportation Studies
Massachusetts Institute of Technology
Cambridge, Massachusetts

March 27, 1975

I.

SUMMARY

Description of Research

This report presents the findings and recommendations of research performed by the Massachusetts Institute of Technology under Phase I of a contract with Environmental Protection Agency to help identify courses of action to aid the integration of air quality maintenance and transportation planning. The research objectives were:

1) to identify obstacles to the incorporation of air quality considerations into federal, state, and local transportation planning and decision-making processes;

2) to identify obstacles to the implementation of transportation options of potential benefit to air quality;

3) to identify how changes in traveller behavior, in the range of available transportation options, and in decision-making processes might facilitate the incorporation of air quality considerations into transportation planning and decision-making or facilitate the implementation of desirable transportation options;

4) to identify elements of EPA's activities that are conducive to air quality-sensitive transportation planning and decision-making and to the implementation of beneficial transportation options, and to identify counterproductive activities;

5) to define a short-range program that can be undertaken by EPA, either alone or in cooperation with DOT, to accelerate the incorporation of air quality requirements into transportation planning and decision-making, and to accelerate the implementation of transportation options beneficial to air quality;

6) to define a long-range program with objectives similar to those described above.

Under the Phase I contract, an initial discussion paper was prepared, identifying likely problem areas in EPA's transportation activities and proposing a preliminary list of actions EPA should take to strengthen the transportation control planning process and to overcome difficulties encountered. In cooperation with EPA officials and the Joint DOT/EPA Advisory Committee, the Boston and San Francisco metropolitan areas were selected for major field visits, and Phoenix-Tucson was selected for a secondary investigation.

Interviews with federal, state, and local officials and with private interest groups were conducted in the selected areas to identify problems associated with transportation control plans; to gain insight into

relationships between air quality, transportation, and land use; to appraise changes in process or in prospect with respect to transportation options, traveller behavior, and decision-making processes; to identify barriers to effective air quality control and key levers for facilitating implementation of air quality programs; and to identify specific possibilities for EPA action. The field visits were guided and supplemented by investigations of transportation options, the relation of air quality to other federal and state programs (safety, energy conservation, etc.), and issues in interagency and organizational coordination.

Problem Areas Identified:

Ten major problem areas were identified in the course of the research. They are:

1) Uncertainties about the nature and severity of the air pollution problems facing metropolitan areas and about the health and welfare effects of air pollution;

2) Constraints imposed on the transportation controls planning process by strict statutory deadlines and limited resources;

3) Incomplete information about the effectiveness, costs, and implementability of transportation control options;

4) Credibility problems (often stemming in part from uncertainties and incomplete information); communication breakdowns among agencies and with the public; and minimal citizen participation (often due in part to tight deadlines);

5) Failure to explicitly investigate social and economic effects of proposed transportation control strategies, resulting in controversy over the perceived costs and benefits of the controls;

6) Lack of interdisciplinary skills available to transportation control planning bodies, resulting in undue limitations on the alternatives considered and hampering identification of the effects of proposed strategies;

7) Failure to adapt the transportation controls planning process to the existing institutional framework, resulting in inefficient use of resources and lost opportunities;

8) Emphasis on regulation with insufficient attention to planning needs;

9) Insufficient guidance for state agencies' planning;

10) Emphasis on the development of a specific plan with insufficient attention to developing a viable, long-term planning process.

Recommendations:

Procedures should be developed for ongoing air quality planning with periodic review and revision of plans and proposals in response to changing needs or circumstances or new information. Both short range actions to improve the current air quality planning process and longer range strategies for air quality planning are needed. In both cases, the overall objective is a responsive, continuing air quality planning process which is sensitive to multiple goals, cognizant of the effects of proposed actions, and as equitable as possible.

The MIT research indicates that specific means by which the air quality planning process can be strengthened include the following:

1) A program for improving public information on, and understanding of, air quality issues and transportation control options is needed to reduce uncertainties and to dispel confusion over the need for, purpose of, and likely effects of transportation controls. This requires two elements: further information development, and improved information dissemination and exchange.

2) An information base on transportation control options, their impacts, costs, performance, implementation issues, and likely consumer response would assist planners in the consideration of a wider range of strategies, including changes in policy and operations as well as new facilities and programs. In addition, better information on control options and their full implications should help planners identify the positive aspects of transportation controls, making it easier to mobilize support for the proposals, and should allow for planning to minimize adverse effects and to develop compensatory measures.

3) Both already existing and new transportation projects of potential benefit to air quality should be monitored carefully, and the initiation and monitoring of demonstration projects for control plan options which show considerable promise but have not been included in control plans to date should be considered. Information thus developed should be widely distributed so that it provides guidance for ongoing transportation control planning efforts.

4) Continuing involvement of federal, state, and local agencies, private groups, and the general public in air quality planning is needed to make maximum use of existing resources, to engender better understanding of air quality issues and to facilitate the development of air quality programs which are implementable and broadly supported.

5) A systematic interdisciplinary approach to air quality planning would improve the quality of the plans by facilitating the consideration of alternatives and their full range of impacts and by aiding in the investigation of tradeoffs to accommodate social goals including but not limited to air quality.

6) More explicit coordination with the ongoing activities of other agencies is needed. In a number of cases the goals and objectives of other agencies' programs are consistent with, and supportive of, air quality improvements; identification of these mutual benefits may facilitate mobilization of support for proposals. In other cases potential conflicts, both short- and long-run, between agencies' plans and programs need to be identified and resolved.

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FOREWORD

This final report has been prepared by the Massachusetts Institute of Technology pursuant to contract 68-01-2476, "Identify Obstacles to Incorporation of Air Quality Requirements in Transportation", with the United States Environmental Protection Agency. The report identifies findings of the MIT Phase I effort and presents recommendations for future EPA activities.

The authors extend their thanks to the numerous persons in Washington, D.C., Boston, San Francisco, Phoenix, and Tucson, who volunteered substantial amounts of their time for extensive discussions of transportation and air quality issues and who provided background materials to aid this research. In particular, we are grateful to Joel Horowitz of the Office of Policy Analysis, EPA, whose guidance and assistance were invaluable; to the staffs of the EPA Region I and Region IX offices, who provided a basic understanding of the issues involved in the transportation control planning process and assisted in identifying further contacts and sources of information; and to the staff of the U.S. Department of Transportation, whose participation on the project advisory committee and less formal assistance contributed valuable insights and perspectives.

While recognizing these contributions, the opinions and conclusions expressed in this report are those of the authors and are not necessarily those of the U.S. Environmental Protection Agency or of those persons who provided information and assistance in the research. The authors take full responsibility for any inaccuracies and omissions.

THE TRANSPORTATION CONTROL PLANNING PROCESS: FINDINGS AND RECOMMENDATIONS FOR IMPROVED DECISION-MAKING

I. INTRODUCTION

A. Background

Pursuant to the Clean Air Act of 1970, as amended, the Administrator of the Environmental Protection Agency promulgated national ambient air quality standards for six pollutants. The Act and the Administrator's regulations require each state to take steps to reduce emissions from transportation sources wherever such steps are necessary for attainment and maintenance of the national standards.

Motor vehicle-related ambient air quality standards currently are exceeded in 66 air quality control regions. Even after implementation of presently mandated controls on new automobiles and on stationary sources of air pollution, additional transportation controls are needed in approximately 30 air quality control regions to meet the Act's deadline for compliance with the standards. Furthermore, projected increases in automobile use indicate that total auto emissions will start to increase after 1985 unless counter-measures are taken. Thus, transportation controls are needed in a large number of air quality control regions in order to meet the requirements of the Clean Air Act.

The Clean Air Act places primary responsibility for the development of transportation control plans with the states. However, the Act requires EPA to formulate a plan when the state fails to do so and to modify any inadequate state plan.

Although some states submitted approvable plans, in a large number of cases EPA was required to formulate transportation control strategies.

Transportation control plans generally rely on two broad types of strategies: (1) vehicle retrofit devices and inspection and maintenance requirements, to reduce the emissions per vehicle mile travelled, and (2) transportation management to reduce the vehicle miles travelled through such measures as transit improvements, parking restrictions, carpooling programs, and restrictions on automobile use. The intended overall effect is cleaner air, with accompanying diminution of health problems and improvements in the quality of life. Concomitant benefits such as more efficient energy usage, increased safety, more rational use of scarce urban land, and spurred development of transit also are expected.

In a number of metropolitan areas, transportation control plans have been a source of controversy. In several cases, criticism of the specifics of the plans has been harsh, and there is skepticism in some arenas that the control plans can be implemented or enforced. The problems can be grouped into four general areas:

- First, the uncertainties in the nature of the air pollution problem and in the effectiveness of transportation control strategies raise, and make difficult to answer, questions about the necessity and desirability of the controls.
- Second, the plans are seen as being in conflict with values and amenities many persons hold dear, and some are not

convinced that cleaner air is worth the perceived sacrifices.

- Third, the absence of adequate institutional mechanisms for control plan implementation and enforcement, coupled with political opposition to transportation controls, may render the plans unworkable.
- Fourth, some argue that the plans would fail in the long run to achieve the desired goal of cleaner air because of insufficient ability to control the factors that generate demand for transportation, that is, our patterns of land use and growth.

Resolving these problems necessitates, first, a fuller understanding of the reasons these concerns developed so that any misunderstandings can be rectified. In the longer run, the need is to identify ways to integrate air quality maintenance and transportation planning, i.e.,

- to increase the capabilities of federal, state, and local officials to develop and implement politically acceptable transportation control plans which will achieve air quality standards within an acceptable period of time;
- to integrate decisions on transportation control plans with decisions on other transportation actions, land use, and other relevant matters, so that the decisions are mutually compatible and supportive.

B. Description of MIT Work

Beginning in June 1974, MIT has worked in cooperation with the EPA to:

1) identify obstacles to the incorporation of air quality requirements into federal, state, and local transportation

planning and decision-making processes;

2) identify transportation options of potential benefit to air quality, and to identify obstacles to their implementation;

3) identify actual and potential changes in traveller behavior, transportation options, and decision-making processes that are likely to affect the incorporation of air quality considerations into transportation planning and decision-making or are likely to affect the implementation of desirable transportation options;

4) identify elements of EPA's activities that are conducive to air quality-sensitive transportation planning and decision-making and to the implementation of beneficial transportation options, and identify counterproductive activities;

5) define a short-range program that can be undertaken by EPA, either alone or in cooperation with DOT, to accelerate the incorporation of air quality requirements into transportation planning and decision-making, and to accelerate the implementation of transportation options beneficial to air quality;

6) define a long-range program with objectives similar to those described above.

An initial discussion paper was prepared, describing likely problem areas in EPA's transportation activities and proposing a preliminary list of actions EPA should take to strengthen its activities and to overcome difficulties encountered. The

discussion paper was circulated for review and comment within both EPA and the Department of Transportation.

In cooperation with EPA and the joint EPA/DOT Advisory Committee, metropolitan areas were selected for field visits. The criteria for selection were:

1. Geographic representation: the selected cities should be in different regions of the country.
2. Political culture and institutional arrangements: the selected cities should have different political climates and institutional structures.
3. Relationship to DOT/EPA field studies: duplication of effort should be avoided so that a larger amount of information can be developed.
4. Transferability of findings: the selected cities should be facing a variety of issues so that a richness of experiences could be tapped; in addition, the cities should not have unusual circumstances which might tend to reduce applicability to other areas.
5. Size of metropolitan area: the selected cities should be large enough that a broad range of technical, political, institutional, and administrative issues will be encountered.
6. Amount of public transportation development: some public transportation development was deemed desirable so that discussion of issues, opportunities, and experiences would be possible.
7. Extensiveness of contacts with officials and knowledge of city: familiarity with the city and its institutions and previous acquaintance with officials were deemed desirable so that start-up time would be minimized, comfortable working relationships

would be facilitated, and an atmosphere of openness would be likely.

8. Degree of transportation control required: major transportation controls should be needed in order for the selected cities to meet the air quality standards, so that a full range of transportation control alternatives would be applicable and potential social, economic and environmental impacts would be numerous.

Based on these criteria, Boston and San Francisco were recommended for the MIT visits. The joint committee concurred in this choice, and added the Phoenix-Tucson air quality control region for a lower-effort field study, because of the large contrasts in approach, city form and control strategies expected there.

In October and November, interviews with federal, state, and local officials and with representatives of private interest groups were conducted in the selected areas. The purpose of the interviews was to develop a fuller understanding of problems and issues stemming from transportation control plans and to identify opportunities for positive EPA actions. The interviews were guided by discussions with EPA, the EPA/DOT Committee, and DOT, and were supplemented by study of transportation options, interagency and organizational issues, and the relation of air quality to other federal and state programs.

The sections that follow present the major findings and recommendations that have emerged from the MIT work. The discussion is structured by substantive topics, with examples from the field visits, rather than by major case study because it is believed that this approach better provides a picture of the issues, needs, and

opportunities associated with the transportation/air quality interface. In addition, because much of the information gathered through interviews was given confidentially, sources of information are identified only in general terms.

II. FINDINGS

A. Effects of Clean Air Act Deadlines and Court Suits

The Clean Air Act and associated regulations require that ambient air quality standards be achieved no later than May 31, 1975, unless a particular area can qualify for an extension by demonstrating that certain elements of the necessary control strategy will not be available by 1975; that there are no unused alternatives to these delayed elements; and that available emissions controls will be applied as soon as possible. Thus, if a control measure is "technologically feasible", "practicable", "available", and "reasonable...under the circumstances", it should be part of a plan before an extension is given. In any event, the maximum extension available under the Act is two years, with an additional one-year extension possible only upon application of the governor of the state and showing of exigent circumstances at a formal hearing. In general, then, air quality control regions must meet the standards by 1977.

In those air quality control regions where emissions limitations on stationary sources and reductions in auto emissions through the Federal Motor Vehicle Control Program are insufficient to achieve the standards for carbon monoxide and photochemical oxidants, transportation control measures, as authorized by the Act, are needed. However, the EPA Administrator noted that neither the states nor the Environmental Protection Agency had any practical experience that would permit the immediate development of meaningful transportation control plans or the prediction of their effects on air quality. Consequently, the Administrator advised that adoption of transportation control

plans could be deferred beyond the statutory deadline for submission of implementation plans but that the submitted implementation plans would have to define the degree of emission reduction to be achieved through transportation control measures and identify the measures being considered. States were required to submit adopted transportation control plans no later than February 15, 1973.

Many states requiring transportation controls requested 2-year extensions for the attainment of the motor vehicle-related standards based on the unavailability of transportation control measures. The Administrator granted such extensions on the grounds that transportation control measures would not be available soon enough to permit attainment of the standards within the time prescribed by the Act.

In some cases, the extension meant that air quality control regions' transportation control strategies would be targeted to a 1977 deadline. Certain other air quality control regions would not have to develop transportation control strategies at all, because the application of motor vehicle emissions reductions and stationary source controls in the 1975-77 period would be adequate to meet the standards.

The granting of additional time for transportation control plans led to two lawsuits against EPA. In City of Riverside v. Ruckelshaus, 4 ERC 1728 (1972), the U.S. District Court held that the Administrator had a non-discretionary duty under the Clean Air Act to promulgate a complete implementation plan for Los Angeles, including a specific transportation control plan, that would meet the standards by the appropriate date. The second suit, National Resources Defense

Council v. EPA, 475 F. 2d. 968 (D.C.Cir. 1973), applied to all areas needing transportation control plans except Los Angeles. The court held that EPA could not extend the deadline for submission of the transportation control elements of the state implementation plans beyond the date specified by the Clean Air Act, nor could EPA grant extensions for attainment of auto-related standards where specific transportation control plans had not been included with the implementation plan. The court therefore required EPA to rescind its extensions for submission of transportation control plans and also to rescind the extension granted to several states to delay implementation of such plans until 1977. In addition, the court ordered the Administrator to require submission by April 15, 1973, of complete implementation plans meeting the Clean Air Act requirements (i.e., including detailed transportation/land use control strategies where necessary).

Thus, several states were notified in February 1973 that they must submit a plan within six weeks that showed achievement of the standards by 1975; at that time they could request an extension of up to two years if the specific requirements for such extension were met.

The effects of this court order must not be underestimated. Those states that were completing transportation control plans with a 1977 attainment date found themselves in the position of needing major revisions to their plans in an extremely short amount of time. Some states, including Massachusetts, decided that it was impossible to do this because of manpower and funding shortages, leaving EPA with the responsibility of preparing and promulgating the plan. States which had been assuming no transportation control plan would be needed

to achieve the 1977 deadline discovered that transportation controls in fact would be required because auto emission standards would not be fully implemented in 1975. Again, EPA often was left with the responsibility for developing the needed strategies.

The resulting confusion and time constraints unarguably took their toll on the quality of the transportation control plans that were produced. Many of the problems that surfaced during the MIT study stem at least in part from the overriding pressures resulting from the tight plan submittal and air quality attainment deadlines mandated by the Clean Air Act and subsequent court decisions. That significantly better plans might have emerged under less difficult circumstances is a possibility that should be kept in mind when examining what actually occurred.

B. Other External Constraints on Transportation Controls Planning

Several other external factors which have had significant impact on the transportation control planning process should be noted. The deadlines of the Clean Air Act require that the ambient air quality standards be met not later than 1977; however, it appears that at least 10 air quality control regions can do so only through massive gasoline rationing. In San Francisco, one of the areas where gasoline rationing is a major strategy of the control plan, few believe such rationing ever would be permitted. Indeed, EPA has stated its intention not to implement gasoline rationing unless required to do so by law. The lack of belief in this element of the control plan has fostered skepticism about the other control strategies; some appear to regard the entire plan as a mere paper exercise, not to be taken seriously. By necessitating the inclusion in plans of control elements that are considered totally unacceptable and unlikely to be implemented, the current deadlines actually may undermine planning efforts.

Recently proposed amendments to the Clean Air Act would help to alleviate this problem by providing flexibility in setting dates for achieving standards. Even so, many of those interviewed felt strongly that good faith progress toward achieving the air quality standards, rather than strict adherence to deadlines, was the only appropriate measure for transportation control plans. They argued that many of the transportation control options they consider most desirable (e.g., rail transit) take ten to fifteen years to implement, and that the reasonableness of various strategies, not their speed in reducing pollution levels, should be the prime criterion for their inclusion in control plans.

There has been some slippage in the auto emissions standards, while the deadlines for attaining the air quality standards have remained the same. Thus, the improvement in air quality resulting from

new cars entering the market is reduced, leaving transportation controls to shoulder more of the burden. (Parenthetically, low auto sales for the 1975 model year may indicate that emission reductions from new cars entering the vehicle fleet will be less than originally anticipated.) Again, the current tight deadlines of the Clean Air Act exacerbate this effect. An alternative approach suggested in many of the interviews would be to explicitly link attainment schedules for the primary standards to implementation deadlines for auto emission controls, thereby removing some of the burden from transportation control plans and forcing all concerned parties to recognize that relaxation of the auto controls constitutes a de facto delay in attainment of air quality standards, at least in the most severely polluted air quality control regions.

Another factor has been that some restrictions have been placed on the kinds of transportation control strategies that can be utilized. The prime example is Congressional prohibition of any EPA requirement of parking surcharges as part of transportation control plans, with the result that EPA deleted all such proposed strategies.

Finally, resource limitations have constrained both EPA and the states in transportation control plan development and may have adverse effects on plan implementation. For example, almost all agencies involved in transportation control planning contacted during the field studies stated that new staffing needs had been identified but could not be met because of a lack of funds to hire additional personnel; that existing personnel could not devote sufficient time to maintain adequate contact with other agencies and interest groups; and that certain impact studies and investigation of potentially promising

alternatives could not be performed because there were insufficient resources. For example, about $150,000.00 was spent on the development of a Boston transportation control plan (since revised). Most of this amount went to a private consultant chosen by the state and EPA to assist in developing the control plan. This amount, which represents the total contractual expenses from the beginning of the first contract through promulgation of that plan, is small indeed when compared with the multi-million dollar cost of recent regional transportation planning efforts. Of course, the figure does not include internal expenses of the state and EPA, but those resources also were severely limited. At one point, the EPA regional office found it necessary to use summer interns and employees of completely unrelated divisions to communicate with employers who were filing employer action plans. Such resource constraints undoubtedly had as severe an impact on the transportation control plans, and the planning process, as the time constraint mentioned previously.

C. The Need for an Overall Air Quality Planning Framework

To date, most of the activity in air quality planning has been oriented toward developing plans and implementation strategies in response to specific regulations: stationary source emissions limitations programs, motor vehicle emissions limitations, transportation control plans, indirect source reviews, parking management plans, and air quality maintenance programs.

There is growing recognition that the various air quality programs must be coordinated carefully to achieve the maximum results, since the programs in many ways are interdependent. For example, the slippage in the dates for auto emissions reductions implies a need for other programs to pick up a larger share of the total reductions if the standards are to be met by the current deadlines. Moreover, better linkages among programs can permit more flexibility. Arizona officials, for example, favor setting emissions limitations for motorcycles since that would diminish the reductions to be achieved through transportation controls.

EPA is working towards the development of an air quality management process which would provide more explicit linkages among the air quality programs. This is highly desirable since it would help to eliminate some of the confusion that has arisen over how the programs fit together (the relationship of the indirect source review regulations to the parking management review regulations, for example, perplexed many) and would open up the possibility of making tradeoffs among the various programs while still achieving the standards.

In order to develop a coherent framework for air quality planning, it is important to account for the institutional arrangements under which

such planning occurs. In many cases, different groups within agencies or different agencies altogether have responsibility for the different air quality programs. In California, for instance, the state Air Resources Board and its local counterparts have primary responsibility for stationary source controls, retrofits, and so on, while the Department of Transportation and the regional transportation agencies are charged with transportation control plan development. It is not always clear what state agency should have primary responsibility or final authority over air quality planning or it elements. In Massachusetts, for instance, there is continuing discussion of the appropriate roles of the Departments of Transportation and of Environmental Affairs. Adding a further layer of complexity are

- the multiplicity of county and city level agencies with some jurisdiction, either direct or indirect, over air pollution sources (well over 100 in the San Francisco Bay Area);
- overlapping or, in some cases, gaps in jurisdictional authority (as, for example, when transportation planning areas are not congruent with air basins, the case in Arizona); and
- the disagreements and differences in emphasis in policies, goals and objectives which sometimes exist among agencies at various levels of government. (For example, air quality is a number one priority of EPA Region I while it is a lower ranking priority of the city of Boston; the Massachusetts Bay Transportation Authority (MBTA) stresses improvement of the existing physical plant, long-term rail transit extensions to suburban areas, and deficit control, whereas some of the air pollution control strategies considered by transportation controls planners were relatively quickly implementable transit options which (at least in the short-run) might increase deficits.)

All these factors must be addressed, and conflicts resolved, in order to achieve the necessary institutional coordination and cooperation for overall air quality planning. This implies that the roles and responsibilities of all relevant agencies and levels of government must be defined; procedures for interagency exchange of information and coordination of work must be developed; and an orderly mechanism for conflict resolution and an appeals procedure must be created.

The success of air quality planning depends not only on the ability to control emissions but also on the ability to guide development in ways that will minimize both the feared deterioration in specific areas and the expected long term growth in emissions. Location decisions for pollution sources such as power plants and industries must be checked carefully for their air quality effects, and existing regulations are aimed at doing this. More difficult to regulate, however, are decisions on such matters as housing, sewer and water systems, and so on. For example, concern that grants for major sewer and water development in suburban and exurban areas will lead to further dispersion accompanied by vast increases in vehicle miles travelled was expressed in both the Bay Area and Boston. Thus, to be effective in the long run, air quality planning must be tied to decisions on land use, resource development, transportation, housing, and commercial and industrial development, etc.

This implies, first, another level of institutional cooperation: not only among those groups and institutions with direct or explicit air quality responsibilities, but also among those groups and institutions whose programs have indirect, subtle air quality impacts. In turn, this implies the need for a high level of sophistication in impact analysis,

identification of the interrelationships of the various programs, and for the development of procedures for reaching agreement on courses of action in light of multiple and sometimes conflicting objectives. Thus, an effective air quality planning framework of necessity must be broad in scope and have multiple attributes.

A third need is for air quality planning to be dynamic. First, the lack of operating experience with many air quality improvement techniques indicates that their implementation realistically should be viewed as experimentation and should be carefully mointored to see whether the desired effects actually are occurring. Fears were expressed in all the field study cities that certain elements of proposed air quality plans might not achieve the desired air quality improvements but would have other, onerous impacts. In addition, some reluctance was voiced about trying certain strategies for fear that they would prove unworkable but would be impossible to eliminate once tried. At least part of the reason for these reservations is that the air quality implementation plan is viewed by many as a one-time planning effort; the development of an explicit (rather than ad hoc), periodic process for plan review and revision could help allay such fears and create an atmosphere in which creative experimentation can thrive.

Second, air quality problems can be expected to change quantitatively and qualitatively as development patterns change and as various air pollution control strategies are applied. Unless there is a continuing, future-oriented air quality planning process, there is a real danger that over-control or under-control of air pollution will occur. Information on the quantity, nature, and spatial distribution of pollutants; the various types of control strategies and their successes or failures and the direct

and indirect impacts of alternative courses of action must be produced on a continuing basis to support a dynamic air quality planning process.

Finally, a successful air quality planning process must provide information to the general public and must encourage participation and input from all concerned parties, not just agencies and governments. This is important to maintain a high quality planning process, since much information on potential impacts and acceptability of alternatives can only be obtained through public exposure. In addition, public involvement engenders better understanding of air quality issues and helps to generate support for the output of the planning process. In all the field study cities, there was a direct correlation between the amount of contact various groups had had with air quality planning agencies and the degree of sympathy, support and understanding for proposals. Before the promulgation of the early versions of the Boston transportation control plan, EPA Region I sought only approval of its plan without input from others in the development of the plan. The state, while working on the TCP, promoted environmental, community and other governmental agency interaction, but only after promulgation of and negative reaction to the first Boston TCP did EPA Region I seek a broad range of input from others.

D. The Need for Better Information about Control Plan Options and Impacts

Transportation control planning requires information about transportation options with potential air quality benefits. The necessary information includes:

1) the range of available options;

2) the potential air quality impacts of each option;

3) the more general impacts of each option, including energy consumption, environmental (non-air quality) impacts, equity, and land use effects; and

4) the financial and institutional constraints on each option.

It was evident both in Region I and in Region IX that adequate knowledge in these four areas does not exist either in EPA or in the state and local agencies responsible for transportation control plan development. These organizations cannot be faulted for this situation; adequate information about most control plan options does not exist anywhere, and underfunded, understaffed agencies cannot be expected to assemble a huge information file or conduct experiments in the process of plan formulation. Nevertheless, the lack of adequate information has adversely affected TCP development. Plans typically were assembled from a narrow range of relatively well-understood options and often, even these options were not thoroughly understood by the involved parties. Air quality and other impacts were not given full consideration in control plan development and options were included which cannot be funded or implemented within the institutional framework of the region. These problems are discussed in detail below.

1) Range of Available Options

Both in Region I and in Region IX, the range of transportation control options included in promulgated control plans has been narrow. The principal VMT control strategies in the current San Francisco control plan, for example, are carpooling and exclusive bus lanes, with a provision for gasoline rationing supplying most of the remaining needed reduction. The new plan now being developed by the Metropolitan Transportation Commission (MTC) will include a somewhat broader range of VMT control measures lifted from the existing regional transportation plan. Neither plan, however, (at least to date) has drawn on the broad spectrum of innovative short-term transportation options available for reducing auto use. The plan being developed by MTC might well benefit from the inclusion of employer incentives to reduce auto travel, a program of coordination between transit agencies to improve the overall transit service, and a synthesis of the carpooling and exclusive lane provisions with parking incentives, preferential and peripheral parking access, or other innovative and more complex options, yet no mention is made of these strategies.

There are several reasons for such shortcomings in transportation control plans. In some cases, there has been little documentation or publicity on many transportation control options (e.g., innovative operating strategies), even among transportation professionals. In other cases, the concerned agencies have not traditionally dealt with short-term, low capital options of the type best suited for transportation control plans. In San Francisco, for instance, the MTC's past planning activities have concentrated on standard fixed-route transit services; in Boston, the MBTA has shown a

similar perspective. Finally, when EPA is called upon to formulate control plans, its minimal in-house transportation staff cannot spare the time required for familiarization with the full range of control options, so the options they consider are taken from a set of relatively well-documented, widely-known transportation strategies. (It should be noted that EPA does not have the mandate to require certain strategies, e.g. transit extensions, that state agencies could include in a TCP).

Another problem is that resource constraints have prevented EPA and the involved state agencies from conducting the background research necessary to identify and document potential control options, or from detailing many of the options actually included in the plans. In the first case, the lack of background research simply reduced the range of control options available for consideration (as outlined in section (a)). In the second case, the generality of certain control plan options seriously compromised the quality of the promulgated plan. For example, the exclusive bus lane provision of the San Francisco control plan was included without consideration of specific alignments, operating policies (e.g. time of day, contra-flow vs. with-flow, simultaneous use by carpoolers, etc.), or funding requirements. EPA Region IX accepted California DOT's specification of 90 miles of priority bus lanes for the entire region without fully understanding the source of this figure. In the absence of such an understanding, EPA could not judge the feasibility of implementing the bus lanes in time to meet the promulgation deadlines. Better information both could increase the range of options considered during formulation of transportation control plans and, ultimately, could increase the range of options included in promulgated plans.

2) Air Quality Impacts

Insufficient information about control plan options often precludes the accurate assessment of air quality impacts. In the case of San Francisco's priority bus lanes, it was impossible to predict the air quality impacts when route alignment had not been chosen. Even when the mechanics of an option are fully detailed, the necessary information for air quality impact prediction may not exist (or may not be available to the transportation controls planner). Carpooling provides a good example of this; it is generally assumed that a carpooling program meeting certain minimum criteria can achieve a 6-10% reduction in VMT, but new evidence indicates that use of idle autos for shopping and other discretionary travel may offset this reduction significantly. New information like this must be substantiated or refuted, documented, and distributed to all concerned parties as quickly as possible. For EPA to ensure an optimal allocation of resources to those control options offering the greatest potential for improvement in air quality, it is necessary to have a full understanding of the air quality impacts of each option.

3) Other Impacts

The potential impacts of any control plan option extend beyond the single dimension of air quality: VMT reduction measures can directly constrain personal mobility and are likely to affect individuals unequally depending upon their incomes, workplaces, and residential locations. Impediments to auto use and encouragement of transit can also affect the local labor market and, over the long term, alter the growth pattern of a region. Finally, control plan options can have significant energy

implications, both positive and negative. Although EPA has felt some external pressure, notably from Congress, not to consider these broader equity, land use, and energy impacts, there is a general feeling both within EPA and among affected interests that some consideration must be given to these impacts in the transportation controls planning process. There are several important benefits to be gained from information about impacts.

At the simplest level, a full knowledge of the effects of each control plan option would enable EPA to counter much of the fierce criticism voiced against the more controversial control plan proposals. Parking controls offer a good illustration of this point. In all three field study areas, particularly in Phoenix and San Francisco, strong objections were raised by elements of the local business community to any strategy for limiting downtown parking. In San Francisco, downtown merchants felt that a constraint on short term parking would threaten downtown commercial activity and ultimately drive many marginal businesses into bankruptcy. In Phoenix, developers were convinced that parking controls would forestall the growth of an urban commercial core (which the city now lacks) by restricting auto access to the downtown area, which has no commuting alternative to the automobile. In Boston, Chambers of Commerce and local business groups feared that parking bans and restrictions would stifle economic development in the central city. In all three cities, a broad spectrum of labor and business groups expressed the belief that parking controls of any type would cause a net decline in construction-related jobs, thereby depressing the regional economy. For each of these arguments, one

can offer intuitive counter-arguments (for example, parking restrictions and traffic control measures applied in some European cities have been accompanied by an increase in retail activity within the affected areas), but information now available for impact analysis is usually insufficient to support or refute these claims with any degree of persuasiveness. Better information about impacts would help to alleviate this problem.

A better understanding of impacts would also encourage the selection of a minimally disruptive control strategy by allowing for explicit consideration of social, economic, and environmental factors during the selection of specific transportation control options. To date, the major criterion for selection of options has been - at least in principle - the degree of air quality improvement, with only secondary consideration given to social, economic, and other environmental impacts. Better information would permit detailed consideration of non-air quality impacts and the selection of a subset of options which minimize the level of adverse impacts while achieving the air quality goals.

Beyond the adverse impacts of individual control options, there are also synergistic impacts resulting from the joint effect of two or more options. Joint air quality impacts are relatively simple to demonstrate - carpooling and exclusive bus lanes, if designed to complement each other by allowing carpools into the bus lanes, can have a far greater impact on air quality than if operated separately - but synergistic impacts also occur in social, economic and environmental effects. For example, the joint effect of long distance, radial transit lines and good feeder to transit ultimately may be further decentralization of the metropolitan area and increased air pollution, although the short term impact is a reduction in

auto VMT. These impacts are clearly important to EPA, and can only be understood through an increase in the availability of information on the effects of transportation control options.

4) Financial Constraints and Institutional Framework

Because EPA's funding resources are limited and because EPA must rely on other organizations for implementation of transportation control plans, it is of primary importance that financial and institutional factors be considered throughout the controls planning process. This requires a thorough understanding of four areas:

1) the existing institutional framework for air quality control, transportation planning, and operation of transportation services; this includes national, state, regional, and local governments and private operators.
2) potential funding sources for transportation options, again at all levels.
3) the funding requirements of each transportation control option, for all levels of government that will be involved in implementing and enforcing the option.
4) the institutional arrangement necessary for implementing each option.

The importance of financial and constitutional factors was apparent in both Boston and San Francisco. EPA proposed a half-hour extension of Boston's 7-9:30 A.M. parking ban (to increase its effectivenss in improving air quality) only to discover that the thousands of dollars required for resigning would not be available. At a different level, two major criteria being used in the development of San Francisco's revised control plan are the availability of funding and the existence of an appropriate implementation agency for each option under consideration. In both cases,

adequate information about financial and institutional factors is a necessary prerequisite to control plan formulation.

5) EPA Credibility

The inadequacy of the information base upon which transportation control plans have been founded detracts from the quality of control plans and seriously undermines EPA's credibility with affected interests and the public. Often EPA is unable to defend the choice of a particular control strategy over other potentially feasible strategies, unable to spell out the details of a particular strategy, and unable to refute exaggerated claims of adverse control plan impacts. Affected interests react negatively to this uncertainty; EPA appears unwilling to give proper consideration to control plan impacts during plan formulation and unwilling to discuss these impacts publicly. The public thus receives the impression that the EPA is incompetent and insensitive to the non-air quality impacts of control plan options. News media representatives are often confused by the language and generality of promulgated control plans, which merely reflect the dearth of background information. In all three case study cities, reporters stated that EPA had not yet managed to adequately inform the public on how transportation affects air quality and that the news media found it hard to get clarification from EPA. They noted that opposition groups often did a much better job of publicizing the potential faults of EPA's proposals than EPA did of publicizing the potential benefits, and some resented what they felt was an EPA attempt to restrict information on adverse effects.

SUMMARY AND RECOMMENDATIONS

A lack of information on the full range of transportation options, their impacts, costs, performance, implementation issues, and likely consumer

response has hampered transportation control planning. Background materials and simple methods and procedures for evaluating alternative transportation control options are needed to aid in the selection of effective control strategies. For many of the proposed transportation options, transportation research agencies around the country have published data covering the standard performance measures, social and economic impacts, and (occasionally) effects on air quality and energy consumption. Where such information already exists, drawing it together into a coherent package for each option would be of great help.

In a number of areas, transportation innovations proposed in control plans already are in operation, although most of them were not designed explicitly to achieve air quality improvement. Careful examination of their performance would yield useful information on costs, market response and air quality, energy, and other social, economic and environmental factors. In addition, careful monitoring of transportation options being implemented as part of control plans would yield useful information for updating, revising, extending, and improving the quality of future transportation control plans.

Many of the options considered for transportation control plans have not been fully researched, and information about some or all of their impacts does not exist. For these options, active involvement on the part of EPA in conducting research would be necessary. Possibilities for EPA action include:

1) initiating and monitoring demonstration projects for control plan options which show considerable promise but were omitted from initial control plans because of uncertainty about impacts or unfamiliarity with details of operation.

2) assuming a "facilitator" role in one or more cities in the implementation and monitoring of the entire control plan. Any such activities should be coordinated with the Department of Transportation and other affected federal, state, and local agencies; results of such efforts should be documented carefully so that they can provide guidance for future transportation control planning.

No program of information acquisition can be effective without a concurrent program of information dissemination and exchange. Detailed information must be available to all groups involved in control plan formulation, through written documentation, panel discussions, workshops, and training sessions.

E. The Need for Ongoing Involvement of Federal, State, and Local Agencies Officials, Interest Groups, and the General Public

Continuing involvement of other federal, state, and local agencies, officials, interest groups, and the general public is crucial to a successful air quality planning process. Broad-based participation can make a number of contributions to planning activities: through cooperative interaction, the planning agency can better identify and clarify relevant issues; can develop and analyze a range of alternative strategies and their implications; and can find courses of action most likely to be acceptable in both the technical and political senses. A major reason for an active involvement program is the need for information exchange. Other agencies, interest groups, and the public are important sources of information. Other agencies and groups often can provide data or even technical assistance to the air quality planning agency; citizens and interest groups may also be able to provide data, and perhaps more importantly, can assist in the assessment of alternative strategies by providing insights and perspectives on their likely effects and acceptability. In addition, plans and programs both in the public and private sectors may have significant impacts on the viability of air quality programs; an example would be decisions on land development in particular areas. There is a clear need to be cognizant of such plans so that they are accounted for in air quality planning.

By the same token, other agencies, interest groups, and the public need to be informed of the activities of the air quality planning process, so that they can be in a position to provide useful input.

In addition, continuing interaction helps to engender the mutual understanding and respect and good working relationships that are needed to implement air quality strategies. In the field studies, it was always the case that the more personal contact there had been between EPA and/or the responsible state agencies and those interviewed, the more respect and willingness to cooperate there was.

Thus, an effective public involvement program requires three elements:

- personal interaction: two-way contact and communication between agency staff and the community;
- information dissemination: the provision of agency information on the scope and nature of its activites, on the actions under consideration, and on the expected impacts of such actions; and
- information collection: obtaining information and data on the activities, needs, and different points of view of the community.

It is widely agreed both by the EPA offices and the state and local agencies contacted during the case studies that more intensive interaction was needed in the development of air quality plans, but time and resource constraints made this difficult. As air quality planning efforts continue, however, new opportunities for improved involvement procedures are available, and these opportunities should be seized upon both as a means of overcoming some of the problems that have arisen to date and as a means of generating active support and cooperation in the future.

It is useful to examine some of the issues that have emerged over current transportation control plans, since it appears that many of these issues could be resolved - or at least, clarified - through better interaction procedures. First, there appears to be minimal public understanding of air quality issues and of the benefits of cleaner air. Bay Area pollution experts noted, for example, that many persons seem to associate air pollution problems with "dirty skies" and "bad smells", although adverse air quality conditions often exist without either symptom or with such effects only minimal. As a result, some segments of the public view air pollution in the Bay Area - erroneously - as an occasional problem. In Boston, without the "dirty skies" effect and in the absence of eye-irritating pollutants, many people consider the air pollution problem to be non-existent. Under such circumstances it is not surprising that the proposed air quality control strategies are viewed in some quarters as "overkill"; the strategies are aimed at solving the measured air quality problems, whereas the perceived problems are much smaller. What is needed to reduce this gap between public understanding of the issues and the technical experts' understanding is extensive information dissemination.

In both Phoenix and Boston citizens and interest groups raised strategies at the public hearings, a forum in which extensive and substantive exploration of issues is nearly impossible. In the Phoenix case, the sheer distance from the regional EPA office (in San Francisco), plus the fact that differences of opinion on the need for various strategies existed between EPA and the state agencies

made it difficult to identify and respond to the concerns raised. The point, however, is that public hearings are not sufficient as the primary means of information exchange between planning agencies and the community.

Another problem that emerged during the field studies is that local governments and agencies are not sufficiently plugged into the transportation control planning process, and as a result information is being lost and positive opportunities to improve control plans are being overlooked. In a number of Bay Area cities and in Phoenix and Tucson, for example, a variety of transit and paratransit options, bicycle paths, and carpooling programs are being planned or even implemented by local agencies, but so far these activities have not been accounted for in the transportation control plans.

Another problem has been that information exchange has not always been timely nor has it appeared to reach the appropriate persons in some cases. In Boston, for instance, transportation officials have recently expressed concern that the subway system could not accommodate the increases in peak-period riders projected by the transportation control plan. Similarly, some city officials now say that the morning on-street parking bans may not be adequately enforceable. More extensive participation during plan development might have uncovered these issues in time for them to be explored carefully then.

It is recommended, then, that EPA develop a program for public involvement for its own planning activities, and that it require that state and local organizations which assume responsibility for air quality planning do the same.

F. The Need for a Systematic Interdisciplinary Approach

It is generally agreed that air quality plans, including transportation control plans, ideally should be developed utilizing a systematic interdisciplinary approach, bringing together the specialized knowledge of a variety of appropriate disciplines in a joint effort to identify needs, develop alternative approaches to meet those needs, identify the full range of environmental, social, and economic impacts of alternatives, and search for the best possible solutions. There are numerous advantages to such an approach. First, it is likely that persons with different training and experience would have different perspectives and problem solving approaches; these differences create the likelihood that a broader range of alternatives would be put forth than would be the case if any one discipline were solely responsible for the planning effort. In addition, the cross-fertilization effects of various disciplines working together can result in new ideas emerging. Another advantage is that impact identification and assessment and consideration of multiple objectives are facilitated by the availability of multiple disciplines.

Obtaining personnel with the expertise and experience in all the numerous subject areas that need to be considered in developing transportation control plans has been a serious problem, both for EPA and for the state, regional, and local organizations which have assumed major responsibilities for air quality planning. The most obvious way of developing interdisciplinary capabilities is to hire personnel with appropriate training. However, resource constraints may make increases in staff size extremely difficult. The EPA Washington and regional offices, for example, note that the funds simply are not available for ar[illegible]

more than modest staffing increases; all three states dealt with in the field studies face similar constraints. Even so, the advantages of having at least a core interdisciplinary capability in-house may make it worth agencies' efforts to seek out new sources of funding: the in-house staff can interact on a day-to-day basis on projects and can develop sound working relations. which is probably the optimal situation for effective interdisciplinary planning.

Limitations on increasing in-house staff capabilities need not prevent the utilization of an interdisciplinary approach, however; other methods of obtaining the desired expertise often are available. One such approach is to develop interagency agreements to share mutually needed personnel (or to perform work for each other). The obvious advantage is reduced total costs, but there are other benefits: Unnecessary duplication of expertise across agencies can be avoided in this way, and expertise needed only part-time or occasionally in one agency may be appropriately added in a full-time position in some other agency. Thus, interagency cooperation can take advantage of the wealth of resources already available, though not consolidated, in an area, and can help economize on expenditures. In California, several instances of successful interagency arrangements for transportation and air quality exist: for example, the Air Resources Board has assumed primary statewide responsibility for the vehicle-oriented elements of the transportation control plans (retrofit, inspection/maintenance), while the California Department of Transportation is responsible for other transportation control stragegies. In Massachusetts, since July 1974, there has been a fundamental shift in attitude toward greater state and EPA cooperation.

However, much work remains to be done in establishing interagency working arrangements.

The basic need when following the interagency approach to achieving interdisciplinary capabilities is for extensive coordination. Achieving such coordination among agencies with specialized primary expertise is rarely a simple matter, however. In many cases such seemingly small problems as physical separation make working together or even extensive communication difficult. This might be avoided by setting up special project offices or by actually 'lending' personnel, but these approaches may creat supervisory, reporting and budgetary difficulties.

Another factor which may make interagency coordination difficult is the so-called "cultural gap" that often exists between separate agencies: this is characterized by an apparent lack of understanding or interest among professions, sometimes exacerbated by differences in the scope of different agencies' activities and in the time frame of their concerns and occasionally by conflicts in their objectives. A third consideration is that each agency is likely to have its own priorities and resource constraints which may preclude or severely limit extensive joint efforts with other agencies.

Thus, interagency agreements can help to alleviate staffing restrictions, but making such agreements effective requires careful planning.

Other procedures for obtaining interdisciplinary capabilities include hiring consultants (for which funds may be more easily obtainable than for hiring new personnel) and providing special training to existing personnel.

through university courses, short courses and workshops, or special arrangements with other agencies. In some cases agencies have found through surveys that existing personnel have specialized backgrounds or experience that can be used profitably and thus have maximized the use of available in-house expertise.

In general, then, agencies have several options for increasing their interdisciplinary capabilities. Earlier sections have pointed out some of the ill effects of not having such capabilities (e.g., inability to consider adequately the side effects of proposed strategies, unnecessarily limited range of options considered, etc.). Thus it is recommended that EPA encourage agencies responsible for air quality planning to enhance their interdisciplinary expertise.

III. CONCLUSIONS

EPA now has a number of opportunities to overcome the problems which have arisen over transportation control plans, to strengthen TCP effectiveness, and to facilitate TCP implementation.

Procedures should be developed for ongoing air quality planning with periodic review and revision of plans and proposals in response to changing needs or circumstances or new information. Both short range actions to improve the current air quality planning process and longer range strategies for air quality planning are needed. In both cases, the overall objective is a responsive, continuing air quality planning process which is sensitive to multiple goals, cognizant of the effects of proposed actions, and as equitable as possible.

The MIT research indicates that the air quality planning process can be strengthened in the folloiwng ways:

1. A program for improving public information on, and general understanding of, air quality issues and transportation control options is needed to reduce uncertainties and to dispel confusion over the need for, purpose of, and likely effects of transportation controls. This requires two elements: further information development, and improved information dissemination and exchange.
2. An information base on transportation control options, their impacts, costs, performance, implementation issues, and likely consumer response would assist planners in examining a wider range of strategies, including changes in policy and operations as well as new facilities and programs. In addition, better information on control options and their

full implications should help planners and others identify the positive aspects of transportation controls, making it easier to mobilize support for the proposals, and should allow for planning to minimize adverse effects and to develop compensatory measures.

3. Both already existing and new transportation projects of potential benefit to air quality should be monitored carefully, and the initiation and monitoring of demonstration projects for control plan options which show considerable promise but have not been included in control plans to date should be considered. Information thus developed should be widely distributed so that it provides guidance for ongoing transportation control planning efforts.
4. Continuing involvement of federal, state, and local agencies, private groups, and the general public in air quality planning is needed to make maximum use of existing resources, to engender better understanding of air quality issues and to facilitate the development of air quality programs which are implementable and broadly supported.
5. A systematic interdisciplinary approach to air quality planning would improve the quality of the plans by facilitating the consideration of alternatives and their full range of impacts and by aiding in the investigation of tradeoffs to accommodate social goals including but not limited to air quality.
6. More explicit coordination with the ongoing activities of other agencies is needed. In a number of cases the goals and objectives of other agencies' programs are consistent with, and supportive of, air quality improvements; identification of these mutual benefits may facilitate mobilization of support for proposals. In other cases potential conflicts,

both short- and long- run, between agencies' plans and programs need to be identified and resolved.

Thus, despite the problems of past air quality planning activities, EPA is in a position not only to significantly improve air quality planning, but to provide the impetus for better transportation, land use, and resources planning.

APPENDIX A: CASE STUDY METHODOLOGY

In October and November 1974, in depth, open-ended interviews were conducted with federal, state, local and regional officials and with representatives of public and private interest groups in each of the case study regions. The purpose of these interviews were: 1) to identify problems associated with transportation control plans; 2) to gain insight into relationships among air quality, transportation, and land use; 3) to appraise changes in process or in prospect with respect to transportation options, traveller behavior, and decision-making processes; 4) to identify barriers to effective air quality control and key levers for easing the implementation of air quality programs; and 5) to identify specific possibilities for EPA action.

In Boston, two rounds of interviews were conducted. The first round, held October 2 - 30, 1974, consisted of eleven interviews focusing on the historical development of transportation control plans, identification of the participants in the formulation of the TCP's and the roles they played, delineation and clarification of problems locally encountered in the development of TCP's, and reasons offered as causes of these problems by the various participants.

In San Francisco, two rounds of interviews were held. The first series of interviews, a preliminary investigation of problems and issues, took place October 15-18, 1974.

Interviews were conducted during the week with the EPA Region IX staff and staff of other federal, state and local agencies involved in the TCP development. Like the first round of Boston interviews, the first series of interviews in San Francisco were of an exploratory nature and were based on an initial preparation which included examination of the material related to the San Francisco Area TCP and other material gathered by MIT staff.

After the initial round of interviews, a mid-study summary of issues and problems was developed for both Boston and San Francisco. Differences in statements concerning the roles of the various persons, agencies or groups were noted so that further clarification of participation could be investigated. The results of the mid-study progress check guided the course of the second round of interviews.

In Boston, a second round of seven interviews was held November 7 - 20, 1974. The interviews focused primarily on examination of the present institutional environment for transportation control planning, examination of the changes that had occurred since the original promulgation of the TCP's and the reasons for such changes, and the identification of specific possibilities for EPA action that are feasible given the dynamics of the particular regional political milieu.

The second series of San Francisco interviews was conducted November 6 - 11, 1974. The purposes were to explore existing issues in greater detail, to seek insight into issues raised on the previous trip and to clarify the level of participation of various agencies and commnunity groups. Thus, those interviews included not only governmental agencies but also environmental and community groups, private interests, and the local news media.

Only one round of interviews was held in the Phoenix-Tucson area because of the lower level of effort of the case study. As Region IX encompasses Phoenix-Tucson, however, the first round of interviews in San Francisco provided a framework for the Phoenix interviews. The Phoenix interviews were held after the conclusion of the second part of the San Francisco case study.

The interviews conducted in the three study areas were open-ended and were not limited to a formal questionnaire due to the great uncertainty surrounding transportation control plans. This format gives the interviewer the greatest possible freedom to pursue information trails which develop during the course of the session. The interviews were, however, structured within the framework of the following hypotheses:

Hypothesis 1. There is a tendency to view transportation control plans as a one time effort and/or as an unchangeable commitment, and as a consequence there are fears that proposed measures won't work or will have serious adverse effects, but will be difficult or impossible to change.

Hypothesis 2. Information on positive responses to transportation controls (what others are doing, options that appear to be successful, etc.) is not reaching those who need it (both in the public and in the private sectors) or is not reaching them in the form and level of detail needed, or is not reaching them quickly enough.

Hypothesis 3. There has been some difficulty in integrating transportation control measures with ongoing transportation and air quality planning processes and other related activities (such as land use planning)

- at the state level,
- at the city or metropolitan agency level, and
- at the local government level.

Hypothesis 4. Local governments and agencies could take a more positive role in transportation control planning, but aren't sure how to get started.

Hypothesis 5. There is a lack of understanding of the effects of air pollution, of the need for transportation controls, and of the positive effects of transportation control strategies.

Hypothesis 6. There is a need for greater flexibility in applying control plan strategies.

Hypothesis 7. Insufficient attention has been given to finding positive incentives for compliance with transportation control plans.

Hypothesis 8. There is a need to develop an open participatory forum in which alternative control strategies can be considered and tradeoffs made.

Hypothesis 9. Current means of funding transportation now limit the range of options being considered.

Hypothesis 10. There are barriers to the implementation of transportation innovations and new technologies.

Interviews generally lasted from one to three hours, with the average length being close to two hours. This time frame enabled the establishment of the rapport which separates the in-depth interview from the superficial interview. The results of any case study utilizing in-depth interviewing techniques are never entirely free of bias. There is always some "filtering effect"; that is, reported results are never entirely value free, but are influenced by the selectivity and operating assumptions of the researchers. In an attempt to minimize this bias and maximize the probability that distortion of the views of those interviewed did not occur, most interviews were attended by more than one researcher and impressions were cross-checked.